Q3. Factors affecting juvenile survival through the federal hydropower system

Uncertainties / Issues:

- Relationship between juvenile survival and flow (travel times)
- Cause of low survival in 1973 and 1977
- Effects future predictions of in-river survival

Implementation:

- 2 passage models (CRiSP and FLUSH)
- CRiSP:
  - Weak relationship between flow and survival
  - '73 / '77 low survival due to passage conditions
- FLUSH:
  - Stronger relationship between flow and survival
  - '73 / '77 low survival due to low flow

Implications

- Direct passage survival (ave. of transported and non-trans. fish) relatively similar between the models for all actions
- Passage models have large effects on projected spawners and jeopardy probabilities; but due mainly to differences in transportation assumptions[1]

[1] WOE Fig. D-7

Evidence related to CRiSP[2]:

- 94-96 LGR-MCN PIT-tag data show weak flow-survival relationship
  ⇒ *1994 had lowest flow and lowest survival*

- Reservoir mortality estimated from gas mortality, predation data
  ⇒ *gas and predation data too sparse to support detailed models*

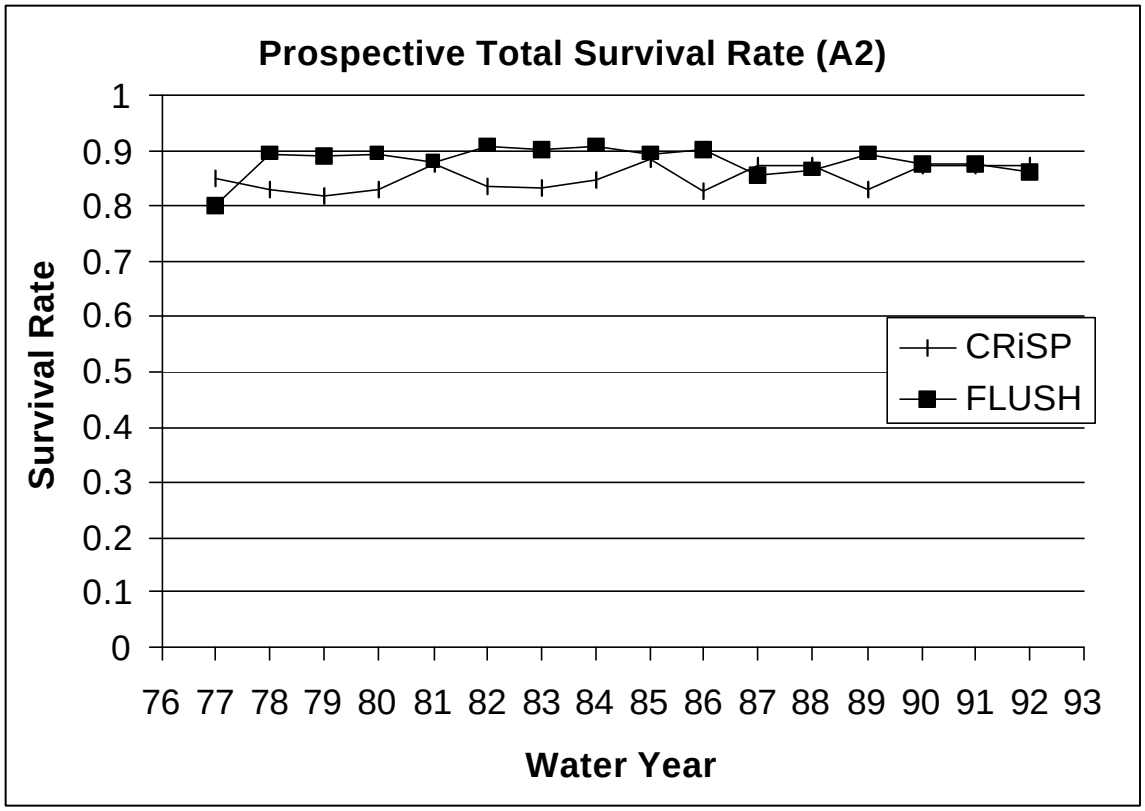
Evidence related to FLUSH:

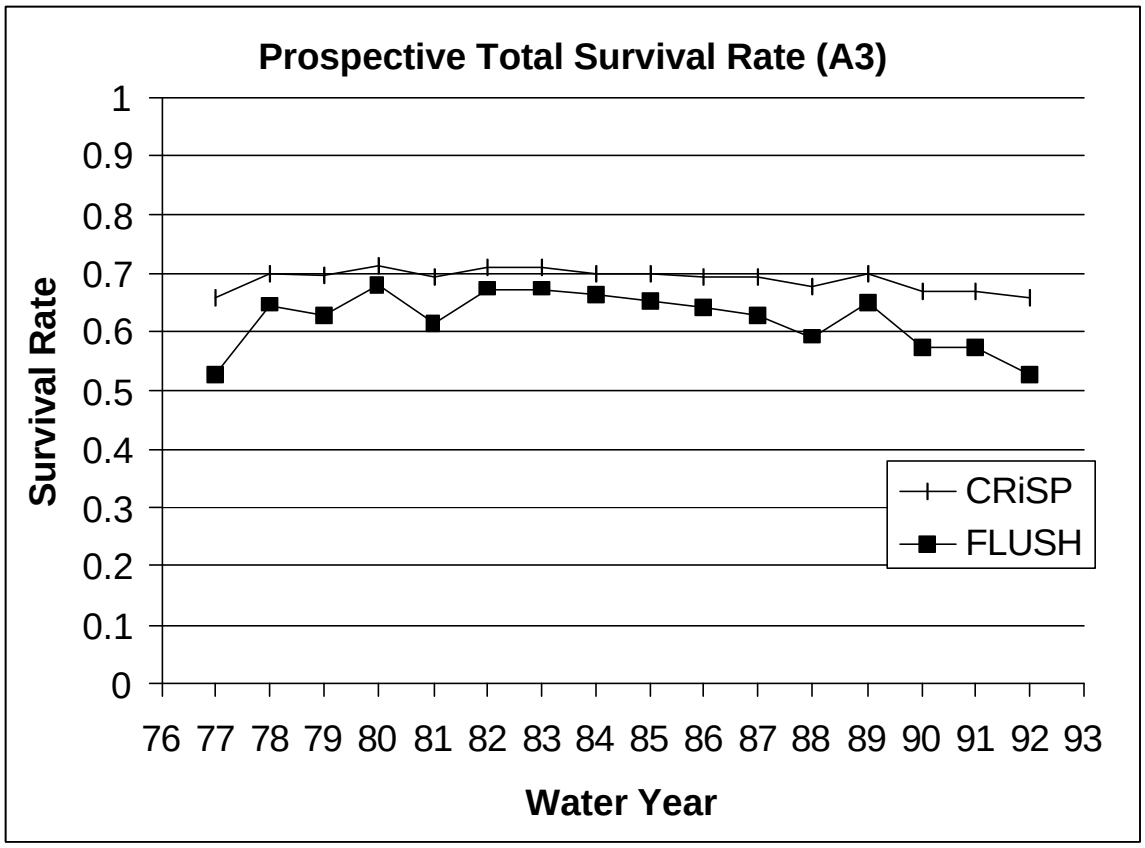
- Negative effects of longer travel times on survival (e.g. physiology, predation) previously documented

- Incremental mortality of Snake River fish linearly related to Water Transit Time

- Reservoir survival estimated from all reach survival data agreed on by PATH sub-group
  ⇒ *earlier reach survival data (Sims and Ossiander) have been criticized*
  ⇒ *survival estimates heavily influenced by 1973 and 1977 data points*

[2] Evidence relating to the passage models is documented in the Weight of Evidence Report, Submission 14 (CRiSP) and 22 (FLUSH), and summarized in Section 4.2.1.1 in the Weight of Evidence Report.


Prospective Total Survival Rate (A2)
Survival Rate
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93
Water Year
CRiSP
FLUSH


Prospective Total Survival Rate (A3)
Survival Rate
1
0.9
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0.1
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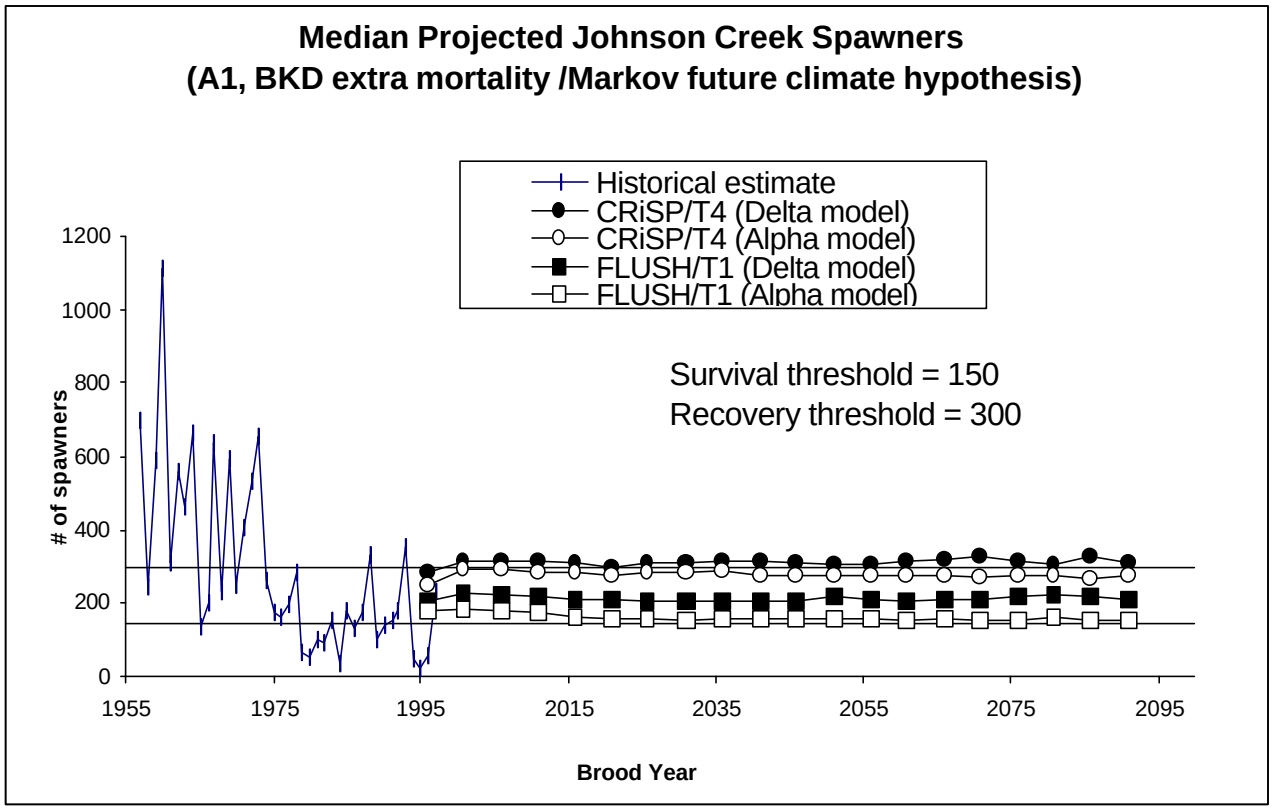
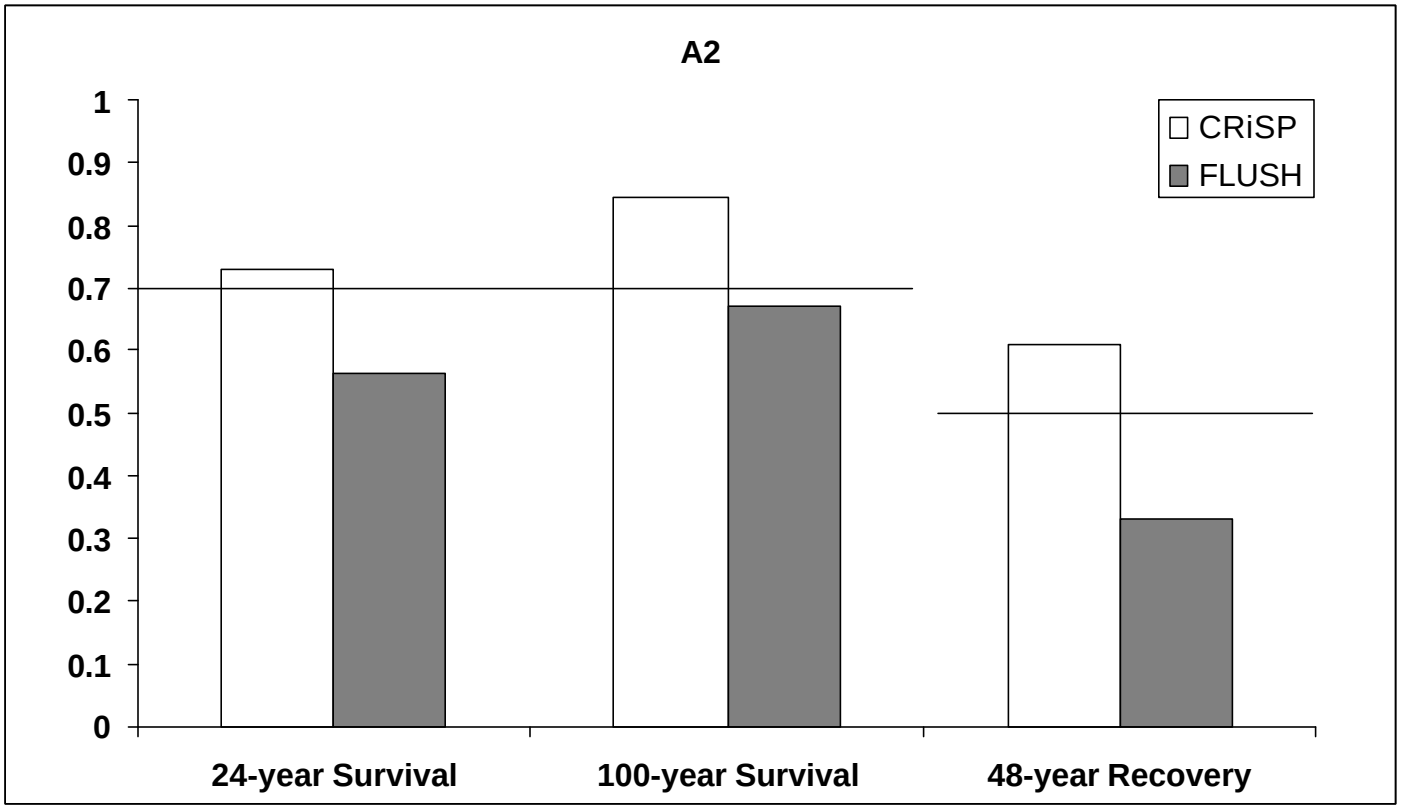
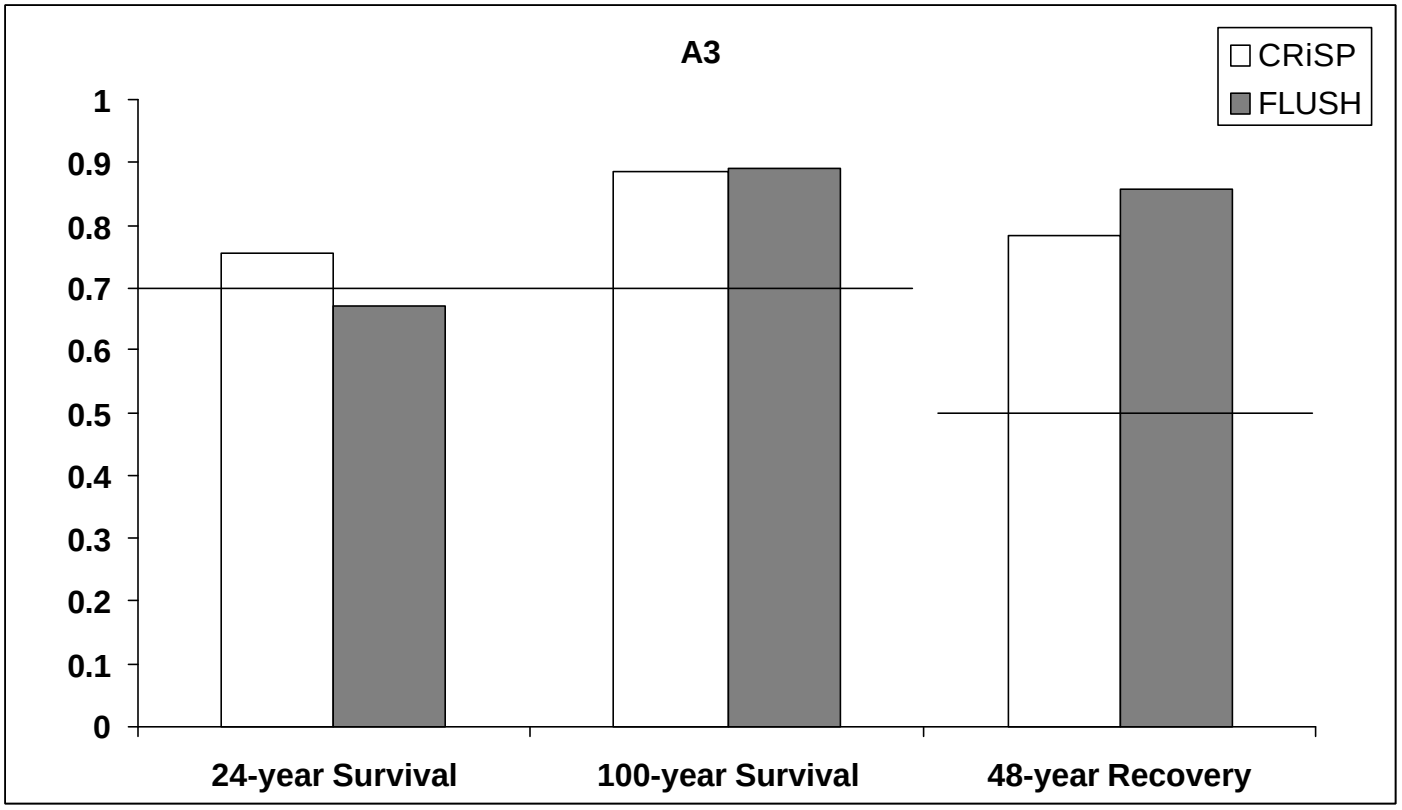
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93
Water Year
CRiSP
FLUSH

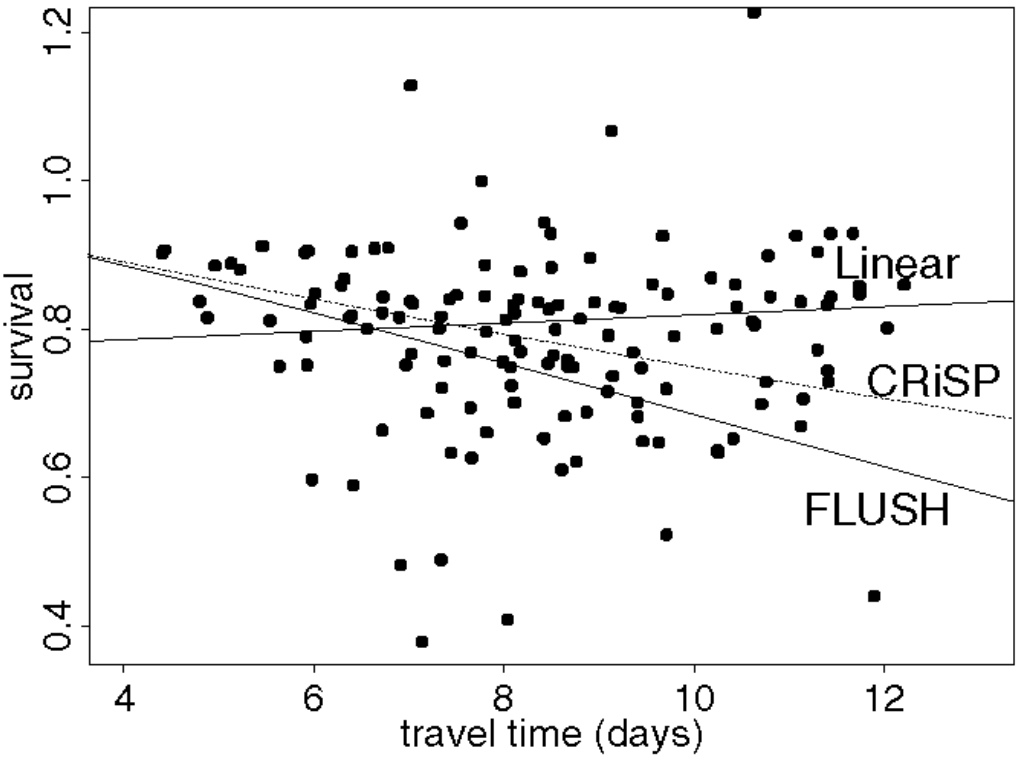

Median Projected Johnson Creek Spawners
(A1, BKD extra mortality /Markov future climate hypothesis)
Historical estimate
CRiSP/T4 (Delta model)
CRiSP/T4 (Alpha model)
FLUSH/T1 (Delta model)
FLUSH/T1 (Alpha model)
Survival threshold = 150
Recovery threshold = 300
# of spawners
1200
1000
800
600
400
200
0
1955
1975
1995
2015
2035
2055
2075
2095
Brood Year

Factors affecting juvenile survival through the hydrosystem





1994-1996 LGR-MCN PIT-tag data



Incremental mortality of Snake River stocks (over Lower Columbia stocks) vs. water transit time